United States Patent [19]

Wolf et al.

[11] Patent Number: 4,612,996

[45] Date of Patent: Sep. 23, 1986

[54] **ROBOTIC AGRICULTURAL SYSTEM WITH TRACTOR SUPPORTED ON TRACKS**

[75] Inventors: Rodney A. Wolf, Amherst Junction; Alan G. Zech, Viroqua, both of Wis.

[73] Assignee: Kimberly Hills, Ltd., Chicago, Ill.

[21] Appl. No.: 521,611

[22] Filed: Aug. 8, 1983

[51] Int. Cl.[4] A01B 69/00

[52] U.S. Cl. ..... 172/26; 104/165; 104/169; 105/29 R; 105/177; 901/1; 172/3

[58] Field of Search ..... 172/2, 3, 23, 24, 25, 172/26, 742, 796; 104/88, 130, 169, 165; 105/29 R, 177; 901/1; 280/43.22, 43.23; 212/218

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2420502	11/1979	France	212/218

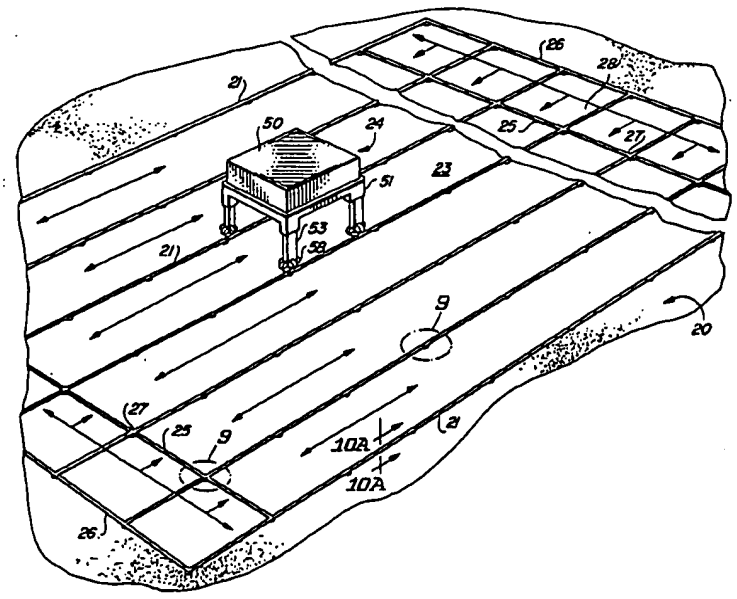
Primary Examiner—Richard T. Stouffer

Attorney, Agent, or Firm—Niblack & Niblack

[57] **ABSTRACT**

A robotic tractor that travels on rails forming a grid over a crop field and automatically performs tasks in the field is described. The tractor is supported on extendable legs that carry dual tandem perpendicular wheel sets. A rotary implement bed supported by the tractor is adapted to carry implements.

5 Claims, 19 Drawing Figures



US005462122A

United States Patent [19]

Yamamoto et al.

[11] Patent Number: 5,462,122

[45] Date of Patent: Oct. 31, 1995

[54] **AUTOMATIC DRIVE CONTROL SYSTEM FOR A BULLDOZER**

[75] Inventors: **Shigeru Yamamoto; Shigenori Matsushita; Shu H. Zhang; Satoru Nishita; Kazushi Nakata**, all of Hirakata, Japan

[73] Assignee: **Kabushiki Kaisha Komatsu Seisakusho**, Tokyo, Japan

[21] Appl. No.: **265,720**

[22] Filed: **Jun. 24, 1994**

[30] **Foreign Application Priority Data**

Jul. 8, 1993 [JP] Japan 5-169023

[51] **Int. Cl.**[6] **E02F 3/76**; E02F 3/00

[52] **U.S. Cl.** **172/2**; 172/4.5; 364/424.07

[58] **Field of Search** 37/301, 236, 403; 172/1, 2, 3, 4, 4.5, 7, 40, 777, 812, 815, 821, 826, 831; 180/6.48, 24.12, 308, 333; 364/424.07, 424.1, 138, 468

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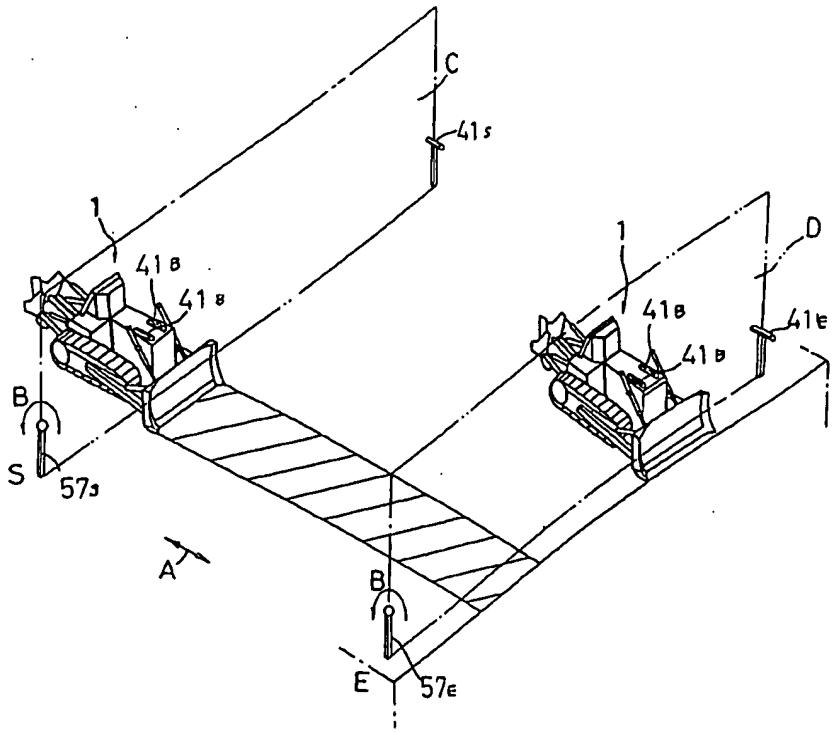
Primary Examiner—Randolph A. Reese
Assistant Examiner—Robert Pezzuto
Attorney, Agent, or Firm—Armstrong, Westerman, Hattori, McLeland and Naughton

[57] **ABSTRACT**

An automatic drive control system for a bulldozer comprising a digging start detector for detecting that the bulldozer is in a digging start position, a digging end detector for detecting that the bulldozer is in a digging end position, a driving direction detector for detecting the momentarily varying driving direction of the bulldozer, and a drive controller for shifting a transmission into a forward gear when the digging start detector detects that the bulldozer is presently in the digging start position; shifting the transmission into a reverse gear when the digging end detector detects that the bulldozer is presently in the digging end position; and controlling the bulldozer such that the driving direction detected by the driving direction detector is made coincident with a target driving direction when the bulldozer is moving from the digging start position towards the digging end position.

21 Claims, 12 Drawing Sheets



United States Patent [19]

Kanato et al.

[11] **Patent Number: 4,825,956**

[45] **Date of Patent: May 2, 1989**

[54] **TRACTOR AND IMPLEMENT WITH IMPLEMENT INCLINATION CONTROL**

[75] Inventors: **Yuji Kanato; Nakashiro Mukai**, both of Ehime, Japan

[73] Assignee: **Iseki & Co., Ltd.**, Japan

[21] Appl. No.: **26,309**

[22] Filed: **Mar. 16, 1987**

[51] **Int. Cl.**[4] **A01B 63/10**

[52] **U.S. Cl.** **172/2**; 172/446

[58] **Field of Search** ..... 172/2, 4.5, 446; 280/446 A

[56] **References Cited**

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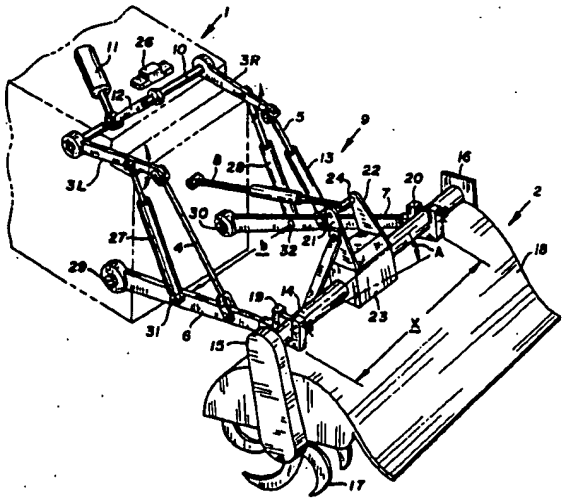
Primary Examiner—Richard T. Stouffer
Attorney, Agent, or Firm—Burd, Bartz & Gutenkauf

[57] **ABSTRACT**

A roll control structure adapted to automatically control an earth working machine, such as a rotary cultivator so that the machine becomes horizontal in the lateral direction irrespective of the inclination of the ground surface, i.e., in such a manner that the machine assumes a posture preset by the operator. The roll control structure is characterized in that it is provided with left and right stroke sensors for detecting strokes, i.e. a distance between arbitrary points on the left and right lift arms in an earth working implement connecting link mechanism and those on the left and right lower links in the same mechanism to determine an angle of inclination in the lateral direction of the implement with respect to a tractor on the basis of a difference between the detected strokes.

9 Claims, 4 Drawing Sheets



United States Patent [19]

Smith

[11] **Patent Number: 4,802,293**

[45] **Date of Patent: Feb. 7, 1989**

[54] **ADJUSTABLE EARTH-MOVING ATTACHMENT FOR A VEHICLE**

[76] Inventor: **Raymond H. Smith, Rte.2, 5AAA, Larned, Kans. 67550**

[21] Appl. No.: **123,608**

[22] Filed: **Nov. 20, 1987**

[51] **Int. Cl.**[4] **E02F 5/00**

[52] **U.S. Cl.** ..... **37/108 R**; 37/268; 37/269; 37/273; 37/274; 37/271; 172/787; 172/799.5

[58] **Field of Search** ..... 37/108 R, 108 A, 110, 37/268, 269, 273, 274, 276, 285, 287, 219, 221; 172/786, 787, 799.5, 155, 169, 188, 191, 201

[56] **References Cited**

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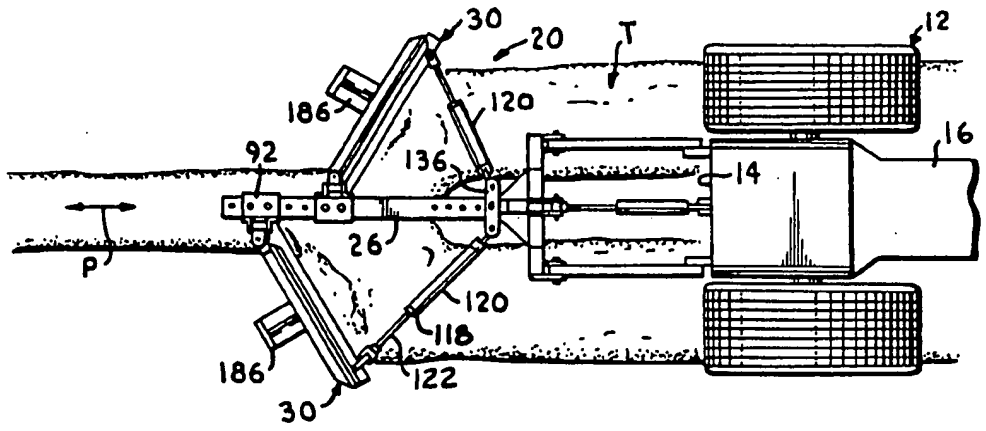
Primary Examiner—Eugene H. Eickholt

Attorney, Agent, or Firm—Litman McMahon & Brown

[57] **ABSTRACT**

An earth-moving attachment for use with a vehicle includes a pair of earth-moving blade assemblies mounted on a main beam. The earth-moving blade assemblies are adapted to be independently movable in several planes with respect to each other and with respect to the main beam so that a plurality of earth-working operations can be performed, and the attachment is amenable for use in conjunction with a wide variety of terrains. The blade assemblies are mounted and designed to efficiently transfer forces with the main beam.

27 Claims, 3 Drawing Sheets



United States Patent [19]

Johnson

[11] **Patent Number: 4,506,465**

[45] **Date of Patent: Mar. 26, 1985**

[54] **PIVOTABLE TOWED SNOW REMOVAL BLADE**

[75] Inventor: Terry D. Johnson, Littleton, Colo.

[73] Assignee: Melvin L. Robinson, Cherokee, Iowa ; a part interest

[21] Appl. No.: 452,117

[22] Filed: Dec. 22, 1982

[51] Int. Cl.³ E01H 5/06

[52] U.S. Cl. 37/268; 172/799.5

[58] Field of Search ..... 37/197, 103, 117.5, 37/268-271, 129, DIG. 3, 2 R, 14, DIG. 12, 130-133, 126 R, 124, 118 R; 172/196, 799.5

[56] **References Cited**

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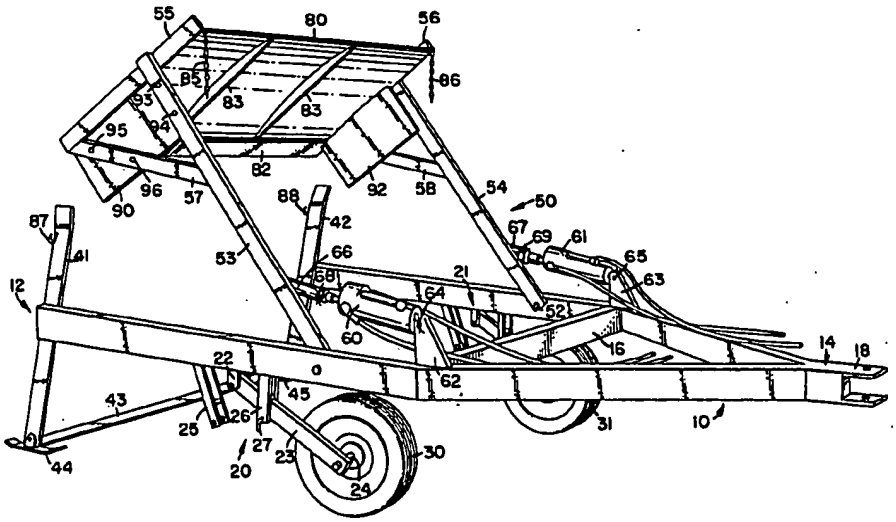
First Press Release: Snowdozer 620, Dec. 28, 1981.
Snowdozer Model 620, not earlier than Jan. 1982.

Primary Examiner—E. H. Eickholt
Attorney, Agent, or Firm—Merchant, Gould, Smith, Edell, Welter & Schmidt

[57] **ABSTRACT**

Apparatus and method for snow removal is disclosed. A wheeled frame having an adjustable suspension capable of operation in a snow removal and a transport position is provided. The frame is open at one end and includes a hitch at the other end for connection to a prime mover. Two vertical snow cutting knives are connected to the frame near the open end thereof with a horizontal snow cutting knife connecting the vertical knives proximate the ground. A snow moving blade is pivotably supported to the frame and actuated by a pair of double acting cylinders to move up and down. In operation the open end of the apparatus is pushed into a pile of snow and snow is cut loose by the knives. The blade is then lowered into close proximity with the ground and near the open end of the frame whereby a selected quantity or block of snow may be pulled or towed away.

3 Claims, 4 Drawing Figures



United States Patent [19]

Reinhardt

[11] **3,738,028**

[45] **June 12, 1973**

[54] **EARTH MOVING APPARATUSES AND PROCESS**

[76] Inventor: **Robert L. Reinhardt, P.O. Box 2451, Lubbock, Tex. 79401**

[22] Filed: **May 30, 1972**

[21] Appl. No.: **257,638**

[52] **U.S. Cl.** **37/4, 37/126, 214/83.32, 198/213**

[51] **Int. Cl.** **B60p 1/00**

[58] **Field of Search** 37/4, 8, 9, 124–126, 37/129; 198/213, 216, 64, 121–125; 214/501, 83, 83.26, 83.32

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Primary Examiner—William B. Penn
Assistant Examiner—Eugene H. Eickholt
Attorney—Ely Silverman

[57] **ABSTRACT**

In earth moving apparatuses dual screw conveyors are resiliently spaced from and supported by a hood thereover which hood is movably mounted at its front end in the mouth of a scoop and transport bowl to accomodate surges in feed, to fully and evenly and quietly and safely load the bowl and to smoothly unload the bowl.

6 Claims, 20 Drawing Figures